Piroplasmosis

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What are Vector-Borne Diseases?

- Disease transmitted by ticks, flies, or fleas
- Not all vector-borne disease are created equal
- They come in all shapes sizes and flavors
- Parasitic
- Protozoal
- Rickettsial
- Bacterial
- Viral
What Are Piroplasms?

- Piroplasms are vector-transmitted protozoal parasites
- Including *Babesia*, *Theileria*, and *Cytauxzoon*
Life-Cycle

Babesia

Theileria/Cytauxzoon

Red blood cell

White blood cell

Tick

Vertebrate

Sp

B

Mz

Gm

Salivary glands

Ovaries/eggs

Hemolymph

Gut

Fusion

Gametogenesis

Sporogony

Schizogony

Gamogony
Whirley

- Whirley 14 month old FS DSH
- 7 day history of lethargy, fever and vomiting
- Treated with Clavamox and Drontal with no response
- Refered to NCSU
CBC

- PCV: 17% (32-48)
- PP: 5.3 G/DL (6.8-8.3)
- WBC: 3.3x10^3 (4.28 - 14.3)
- Plt: 60x10^3 (198 – 434)
- Segs: 660/ul (2.773 - 6.975)
- Lymphs: 2541/ul (0.415 - 4.996)
Chemistry

- Bilirubin: 1.8 (0 - .2)
- ALP: <5 (11 – 58)
- ALT: 48 (27 – 95)
- Glu: 184 (70 – 182)
- Na: 145 (148 – 155)
- K: 3.4 (3.5 - 5.1)
- All else WNL
Clumped platelets on blood smear exam
Closer examination
Cytauxzoon felis

- Tick-transmitted infection of cats
- Apicomplexan protozoan parasite
- Order: Piroplasmida
- Family: Theileriidae
Widespread dissemination of schizonts results in parasitic thrombi formation throughout the body causing multi-organ failure and death (see Figure 2B).
First reported in the domestic cat in Missouri in 1976
Current Distribution
Seasonal Distribution
Cytauxzoonosis: Signs/History

- Acute febrile disease
- Access to outdoors
- History of ticks
- Lethargy
- Dyspnea
- Neurologic disease
- Jaundice
Course of Events Following Infection of Cats

• Entire process is very quick
  - Signs begin 12-15 days after infection
  - Progress from ADR to coma in days
• Tissue schizonts accompany the illness
• Piroplasms may or may not be evident
• Death within 5 days typical
Pathology

- The majority of the clinical signs and ultimately death are due to the schizogenous phase.
- Schizont-laden macrophages occlude small blood vessels and result in multi-organ failure and death.
- Infection of cats with merozoites stages only results in minimal clinical disease.
Schizont-laden Macrophages
Supportive Laboratory Findings

- **CBC**
  - Leukopenia
  - Leukocytosis
  - Thrombocytopenia
  - Anemia
  - Organisms

- **Biochemical profile**
  - Elevated liver enzymes
    - Not always severe
  - Icterus
  - Hyperglycemia
  - Hypoalbuminemia
  - Azotemia (pre-renal)
  - Electrolyte/acid-base disorders
How to diagnose it?
- Atovaquone and azithromycin
- Demonstrated to have efficacy against related protozoan parasites
  - *Babesia microti*
  - *Babesia gibsoni*
Full-scale Trial

- An open-label, randomized prospective study compared survival in cats treated with atovaquone (15 mg/kg PO q 8 hrs) and azithromycin (10 mg/kg PO q 24 hrs) or imidocarb (3.5 mg/kg sc)

- Eighty acutely ill cats with confirmed *Cytauxzoon felis* infection treated at one of 18 veterinary clinics in 4 states
- 32 of 54 cats (60.5%) treated with A&A survived
- 7 of 27 cats (26%) treated with imidocarb survived
- ($p=0.0036$; odds ratio 7.2, 95% CI 2.2, 24).
Results

- Clinical data was not available for most cases
- NCSU cats were VERY VERY VERY SICK!!!
- ICU patients, needed oxygen therapy, treatment for shock, etc.
- Clinical recoveries were NOT rapid, patients slowly recovered after 4-7 days of intensive care
- Mild hemolytic anemia during second week
But....

- By 10-14 days after discharge these cats were acting COMPLETELY normal
- There was complete resolution of hematological and biochemical abnormalities during follow-up visits
- Detection of parasites post-treatment was variable
- Survivors continue to do well as long as 5 years post-treatment
Take Home Points

- Acute Febrile Illness
- Outdoor access
- Pancytopenia
- Hyperbilirubinemia
- Blood smear!
- Diagnose and treat quickly!
- 60+% Survival
● Molly is a 4 year old female spayed American Staffordshire terrier who presents to the NCSU VHC Small Animal Internal Medicine service.

● Thrombocytopenia and anemia.
Canine Babesiosis:

- Historically *Babesia* species have been named based on host and size
- Large canine *Babesia* = *Babesia canis*
- Small canine *Babesia* = *Babesia gibsoni*
There are currently at least 9 genetically unique canine piroplasms

1. *B. gibsoni*
2. *B. vogeli*
3. *Babesia sp. coco*
4. *B. conradae*
5. *B. canis*
6. *B. rossi*
7. *T. annae*
8. Novel sp. in England
9. *T. equi*
10. There will be more!
States where *B. gibsoni* infections were identified
States where *B. gibsoni* infections were identified
States where *B. gibsoni* infections were identified
Risks for Infection

- Breed
  - *Babesia canis* (greyhounds)
  - *Babesia gibsoni* (APBT)
- Dogbite (APBT)
- Ticks
- Transfusions
- Splenectomy
• History
  • Acute or chronic
  • Any age dog
  • Lethargy
  • Depression
  • Pale MM
  • Discolored urine

• Physical
  • Fever
  • Lymphadenomegaly
  • Splenomegaly
  • Pale MM
  • Jaundice
  • Normal?
Hematological findings

- Anemia
- Thrombocytopenia

- If it looks like IMHA or ITP
- You’d better think about Babesia!
Biochemical findings

- Hyperglobulinemia
- Hyperbilirubinemia
- Increased liver enzymes
- Mild azotemia
- Metabolic acidosis

No pathognomonic biochemical findings!
What tests are available?

- Parasite visualization
- Serology
- Polymerase chain reaction

All 3 tests are useful, but PCR is probably the “best test”
Parasite visualization

- Diff-Quik or Leukostat on oil immersion.
- Capillary blood = Ear or toenail
- Look at the entire slide(s)
- False positives due to “debris” or “H₂O”
- A negative slide exam does not rule out babesiosis
Babesia gibsoni infected erythrocytes
Serology

- Not always cross reactivity between species
- So it is best to test against all species
- There are not always antibodies present
- Do acute and convalescent titers
Polymerase Chain Reaction (PCR)

- A positive PCR is consistent with infection
  - Appropriate positive and negative controls
- A negative PCR either means the patient is truly negative or the parasite load is very low
All Dots in Red Blood Cells Are Created Equal

- There is no microscope objective powerful enough to decipher DNA sequence
- Microscopy and serology are NOT able to definitively identify the species of Babesia
- Molecular testing is required to differentiate
  - PCR
  - DNA sequencing
  - Hybridization (Southern etc.)
Conclusions On Testing

● It is relatively easy to say that a dog definitely IS infected (PCR or Microscopy)
● BUT it is nearly impossible to say that a dog is NOT infected (short of splenectomy)
● If I was going to do one test it would be PCR (ideally two consecutive negative tests)
● If I really wanted to know I would do microscopy, PCR and serology for all species
Take Home Points

- Acute or Chronic
- Thrombocytopenia more common than anemia
- Pit Bulls, Greyhounds, Ticks
- PCR best way to definitively diagnose
- Correct identification (by PCR) needed for best treatment
Questions?